volume will comprise about 300 pages of text, 100 numerical tables, and 100 plates or figures in the text. If all goes well, the volume will be published in the autumn of 1904. It will be divided into the following chapters:

Introduction. General principles. Part 1.—Weather: The seasons; spring, summer, autumn, and winter for eighty-seven years. Storms affecting Baltimore. The weather of special days; February 22, March 4, etc. The weather of each decade. Weather forecasting; long-range forecasts; the moon and the weather; sun spots and the weather. Meteorological observations and organizations in Baltimore. Baltimore weather chronology. Part 2.—Climatology: Atmospheric pressure; mean hourly variations; annual march; extremes, etc. Temperature: diurnal march; hourly march; annual march; nonperiodic variations; water in the harbor; soil temperature. Humidity: hourly, monthly, and annual. Precipitation: diurnal, monthly, and annual; excessive; deficient; drought; snowfall. Hail. Fog. Cloudiness and sunshine. The winds: velocity; direction; diurnal, monthly, and annual. Electrical phenomena: thunderstorms; auroras.

Under the title, "The normal diurnal variation of the barometer at Baltimore," Dr. Fassig introduces a table of isopleths, or lines of equal quantity. These were, we believe, first introduced into meteorology in the French edition of Kaemtz's lectures, translated from the German by Charles Martins, Paris, 1843, in which edition a special chapter is added by Lalanne, a French engineer, on the graphic presentation of meteorological data. A chart of isopleths looks very much like a chart of isobars or a chart of contour lines in geography. Dr. Fassig describes his chart as follows: The mean hourly values of barometric pressure for Baltimore are presented in Table I for each month and for the year. The results for each season and for the entire year are also shown graphically in fig. 1 and fig. 2. In Table II, the same values are expressed in terms of departures from the average value for the entire day.

These tables and diagrams reveal for Baltimore the characteristic double barometric curve so well known to the meteorologists from the results of analyses of observations from all parts of the world, with perhaps minor peculiarities due to local conditions. The fluctuations are well marked in all months of the year, the amplitude varying from 0.060 inch in August to 0.071 inch in March. In fig. 2 the distribution of pressure is represented by a method not frequently employed, but one which shows clearly and in compact form the successive changes from hour to hour throughout the year. Upon a system of coordinates representing the hours of the day and the months of the year, isobars, or lines of equal pressure, are projected in such manner as to enable one to find the exact pressure at any hour of any month. For example, to find the average pressure at noon, in April, you run down the vertical line marked noon until the horizontal line marked April is intercepted, and find the isobar of 29.875. This method enables us also to see at a glance the chief characteristics of the seasonal distribution, further emphasized by differences in shading, the lighter shades indicating the lower pressures of the warm months, and the darker shades the higher pressures of the colder months.

In the next section Dr. Fassig has taken the trouble to compute the barometric variations on 60 clear days in January and February, and 30 clear days in July, as also variations on the same number of cloudy days in those months. The curves for the cloudy days coincide very closely with the general curve for all kinds of weather during the summer months, but diverge decidedly during the winter months. The curve for totally clear days also diverges from the normal in the winter during the night and early morning hours. The following section has an especial interest at the present time, on account of the attempts that are being made to explain the ultimate origin and nature of the regular barometric variations.

THE DIURNAL BAROMETRIC WAVE.

The diurnal variations of the barometer described in the preceding paragraphs are not simply of local occurrence, but are part of a general phenomenon extending over the greater portion of the earth's surface. The maximum and minimum phases pointed out occur in all localities at approximately the same hours of local time. As stated above, this pressure wave, as it may be called, has its greatest development in or near the equatorial belt, and diminishes in amplitude with distance north and south of the equator. It has some resemblance to a double atmospheric wave passing completely around the earth from east to west every twenty-four hours, having a velocity at the equator of about 1000 miles per hour. By plotting upon a map of the world the departures from the normal daily pressure for successive hours of the day at a large number of stations uniformly distributed over the Northern and Southern hemispheres, and joining such stations as have equal departures of pressure for the same hour, we have presented to us four systems of pressure distribution, consisting of two areas of low pressure and two areas of high pressure. These systems completely circle the globe and closely resemble in form the cyclonic and anticyclonic systems of the middle latitudes, but differ from them, among other things, in covering an area vastly greater, and in moving in the opposite direction. The diurnal fluctuations of the barometer are the local evidence of this vast double atmospheric wave passing around the globe daily. The westward propagation of these waves near the equator is represented in fig. 5 [not reproduced], the curve showing the time of occurrence of the different phases of the double wave, its amplitude, and the direction of propagation along the path of greatest development. The character of these waves is further indicated in fig. 6 [not reproduced], in which the successive areas of high and low pressure are exhibited at the time of their maximum development in passing from east to west across the North and South American continents.[1]

This double atmospheric wave, or tide, is so intimately associated with the apparent diurnal movements of the sun that the conclusion is almost irresistible that the pressure changes are due primarily to changes of temperature. This relationship has not yet been satisfactorily demonstrated to be that of direct cause and effect, but there seems to be a general consensus of opinion that the primary maximum and the primary minimum phases of pressure are direct effects of the sun's heat. The theory advanced many years ago to account for the chief maximum and minimum phases seems plausible. At the time of day, between 9 a. m. and 10 a. m., when the atmosphere is being warmed most rapidly and the tendency of the air to rise in consequence is greatest, the upper and colder layers impede this upward movement, resulting in a temporarily increased tension at the surface of the earth. When this tension is relieved the barometer begins to fall, reaching its lowest point about the middle of the afternoon when the upward movement of the warm air may be assumed to be least impeded.

As has already been stated above, the pressure wave attains its greatest amplitude in the equatorial belt where the diurnal temperature changes are greatest, and over the continental masses north and south of the equator where the diurnal range of temperature is most marked.

According to Dr. Hann,[2] in seeking an explanation of the diurnal variations of the barometer: "We had better deal with the action of the sun on the upper strata of the atmosphere and treat this as the principal cause. The actinometrical observations show us that these upper strata absorb a considerable amount of heat. The diurnal heating action of the sun on the upper strata would harmonize far better with the general uniformity of the daily barometric oscillation along the different parallels of latitude as well as with its general independence of weather. We need not quite exclude local influences, but these seem to be more of a secondary character." This view is also held by Lord Kelvin, who seems to have been the first to suggest this explanation.

C. A.

METEOROLOGY AT MONTPELLIER, FRANCE.

The meteorological observatory at Montpellier represents the meteorological commission of the Department of Hérault as well as the National School of Agriculture at Montpellier. The observatory and the commission began its work in 1872, or even earlier. The publication of the meteorological bulletin of the Department of Hérault began in 1873, and there has just been published a general index to the 31 volumes, 1873–1903, together with a few words as to the general activity of the institution.

In 1864 the Paris Observatory proposed to make a special study of the progress of thunderstorms through France. The Department of Hérault appointed a special commission to assist

[1] Fassig, O. L. The Daily Barometric Wave. Bull. No. 31, U. S. Weather Bureau. 8vo. Washington, D. C. 1902. Pp. 62–65, 12 pls.

[2] Hann, J. The Theory of the Daily Barometric Oscillation. Quart. Jour. Roy. Met. Soc. London, 1899. P. 40.

Le Verrier in this work. In 1872 the meteorologists of the departments of Hérault, Gard, Lozère, Aude, and Pyrénées-Orientales combined to appoint a meteorological committee for the western Mediterranean region; Prof. A. Crova was the general secretary of the committee. Each of these departments established stations with the necessary apparatus, and according to the original plan the observations were to be collected and published annually, together with the memoirs and discussions. Eventually all documents were to be deposited with the president and secretary of the committee. A public subscription was opened for the purpose of collecting funds for the support of the stations and the work. In August, 1873, the General Council of Hérault voted an appropriation for the printing of the meteorological bulletin of Hérault, and this has been continued annually. In 1879 the former commission was replaced by the meteorological commission of Hérault, established under the auspices of the Minister of Instruction for the Republic. This commission continued the work on thunderstorms started by its predecessor, and originated numerous other works under the direction of its president, Professor Crova. In 1881 Professor Crova was called to occupy the chair of physics in the National Agricultural School at Montpellier, and has utilized this favorable position to develop this organization of the meteorological observatory. In 1885 Professor Houdaille succeeded Professor Crova as professor of physics and director of the meteorological station. In 1888 the faculty of science was authorized to incorporate the laboratory, archives, and library of the meteorological commission with the collegiate department of physics. Therefore, the latter is now installed in a spacious locality adjoining a garden, where one can make experiments in the open air, uninfluenced by the vicinity of dwellings. The total amount of material accumulated in these volumes is very considerable, and the general index greatly facilitates the use of the data by students. Prof. M. Chassant temporarily fills the place of Professor Houdaille, who was attacked by a severe sickness in 1901. The general table of contents is divided into the following four sections:

1. The general alphabetical index by subjects, 18 pages. 2. Systematic index of subjects, 11 pages. 3. Author index, 15 pages. 4. List of plates and illustrations, 17 pages.

This is followed by a bibliography of those connected with the meteorological work of the department covering 58 names of persons or institutions, among whom Crova appears to be the most active.

The bulletins for the years 1902 and 1903 have been edited by Prof. Maurice Chassant, who conducts the course in meteorology and geology at the National School of Agriculture. This college, therefore, may be classed among those in which meteorology is associated with geology rather than with geography or with physics, as is done in many other cases.—*C. A.*

TORNADO IN MOBILE COUNTY, ALA.

[Reported by Albert Ashenberger, Observer, Mobile, Ala.]

On the afternoon of May 30, 1904, a tornado with a typical funnel-shaped cloud occurred in Mobile County, about 12 miles west of the Mobile Weather Bureau station.

The morning weather map of that date showed an area of low pressure central over eastern Arkansas and overlying the lower Mississippi Valley, with an extension of the depression merging with another low area over the lower St. Lawrence River. The accompanying rain area was characterized by numerous thunderstorms, and it was coextensive with the barometric depression.

The day's weather conditions at Mobile were marked by three thunderstorms. The sky was partly covered with clouds until 10 a. m. and was overcast with lower clouds afterwards. The winds were from the south and southwest and of light to fresh velocity. The temperature was normal. A high relative humidity obtained, the percentage recorded at both observations being among the highest during the month. The barograph shows no marked sudden changes; the pressure [reduced to sea level] fell almost steadily from 29.90 inches, at 9 a. m., to 29.76 inches, at 2:45 p. m., then the fall was less rapid and 29.75 inches was registered at 4:45 p. m., at which time a sudden fall of .02 inch occurred; this was followed by a stationary period of two hours and then a steady rise.

At Melton's farmhouse, five and one-half miles from the beginning of the storm track, the projecting top of the chimney was prostrated, and the roof of the kitchen, 50 feet south of the main building, was carried 60 feet in a northeasterly direction. This house did not indicate any sudden atmospheric expansion, as the sashes of a window facing the east were blown inward. About half a mile beyond Melton's house is the end of the path, marked by four prostrated trees. An occupant of the house stated that light rain fell at about 3:30 p. m., and thunder was heard and lightning observed in the southwest. At about 4 p. m. a violent commotion in the intensely dark clouds in the southwest was observed, and then the funnel-shaped cloud, like the smoke from a locomotive, was seen approaching, sometimes descending to the earth, and again receding. In a few moments the tornado passed with a heavy, roaring noise, like an approaching train. No lightning was observed in the cloud, but after the tornado had passed lightning was observed in the southwest, thunder was heard, and light rain fell. Rain amounting to .36 inch fell at Mobile from 4:07 p. m. to 6:05 p. m.

Mr. Leonard Lane observed the storm from the porch of his house, which is about one hundred yards to the right of the tornado's track, and about a mile from its beginning. He stated that the whirl was about two hundred yards in diameter, and the upward spiral movement from right to left was plainly discernible from the flying tree branches and other débris, and the rotating mass while passing his house had the appearance of an immense dry whirlwind without any low moisture-laden clouds.

The width of the path of the storm was not well defined, but near Mr. Lane's place, as stated by him, it was 200 yards; at Melton's place the prostrated fences indicated a width of about three hundred and fifty yards. The estimated value of the property destroyed is $200.

The time used in this report is ninetieth meridian.

HAILSTORM AT PUEBLO, COLO.

[Reported by J. P. Slaughter, Observer, Pueblo, Colo.]

On May 20, the worst hailstorm in the history of the city was experienced. Hail fell from 3:40 to 4:15 p. m., seventy-fifth meridian time. The ground was nearly covered with lumps of ice, ranging in size from ¼ to 2¼ inches, with an average diameter of about 1 inch. Some of the hail is reported to have been 9 to 10 inches in circumference, weighing 4 to 6 ounces. The hail is known to have covered a strip about 6 miles wide, and extended from a point about 8 miles west of this city to an unknown distance to the northeast. There was nothing unusual in the character of the storm except the size of the hailstones.

Damage to windows, fruit, and crops of all kinds will run far into the thousands.

EARLY AMERICAN WEATHER RECORDS.

In the report of the Maryland and Delaware section for May, 1904, Dr. Fassig has reprinted a letter dated February 27, 1755, written by Dr. Richard Brooke, of Prince Georges County, Md., communicating a record of maximum and minimum temperatures as observed with a Fahrenheit thermometer in September, 1753, to August, 1754. Dr. Brooke also says, "I have seen an account of the weather kept by a friend in Philadelphia which agrees with mine."